Pathway level impacts of in situ exposure of fathead minnow to effluent mixtures in the Duluth harbor

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There is a major effort to characterize the potential adverse effects of effluents released from sewage treatment plants in North America. At many locations pharmaceuticals, endocrine disruptors, and other chemicals of emerging concerns are present in the environment at concentrations capable of altering physiological processes in wildlife. In order to elucidate the effects of sewage treatment plants on wildlife, fathead minnows were caged in situ at several locations at the Duluth (MN) harbor, proximal and distal from the wastewater treatment plant discharge location. Fish were also exposed in the laboratory to 100% of effluent as a positive control. Several endpoints such as steroid hormones, vitellogenin, transcriptomics and metabolomics were analyzed. We applied a pathway level approach to understand the effects of the discharge as well as the potential dilution of the adverse effects at distal locations. Effects on gene expression were very similar for the different locations, with a higher amount of changes for the 100% effluent and the higher intensity for fish exposed to locations closer to the discharge site. Changes in gene expression were involved in pathways related to cytochrome P450s, hypoxia inducible factor, neurological function, or embryonic development among others. While distance from the discharge site decreased the effects on gene expression, pathway analysis was very effective in detecting the potential adverse effects of the discharge.

STICs Field	Entry
1 – Influence/profile	Not applicable
2 – Clearance tracking no.	Assigned automatically
3 – Principal Investigator / Project Officer	Gerald Ankley
4- Product title	Copy and paste from abstract
5 - Authors	See abstract
6a- Product type	Presentations and technical summaries
6b-Product subtype	Abstract
6c – Records schedule	Not a senior official
7a – Impact statement	n/a
7b- Product description	Paste in abstract
8 – Bibliographic citation	SETAC North America 33rd Annual Meeting, 11-15 November, Long Beach, CA, USA.
9 - Access	Public
10 – Tracking and Planning Task	2.1.2 2.1.2: AOP-based effects monitoring and exposure reconstruction
10 – Tracking and Planning Product	(2) Case studies evaluating the utility of transcriptomics, metabolomics, and associated bioinformatic methods for comparing the nature and severity of biological impairment as a function of space and/or time to assess the efficacy of remediation efforts within Great Lakes Areas of Concern.
11 – Copyright permission	No
12 - QA	not applicable
13 – Policy implications	No
14 - Keywords	transcriptomics effects-based monitoring wastewater mixture

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